

REMARKS

Claims 1 to 10 are currently pending in the present application. Claims 1, 2 and 10 are amended herein. Claim 11 is newly added. No new matter is added by the amendments to the claims or the new claim.

The Action states that the listing of references in the specification does not meet the requirements of a proper information disclosure statement. The Action further states that 37 CFR 1.98(b) requires a list of all patents, publications or other information submitted to the Office for consideration. A proper information disclosure statement under 37 CFR 1.97(b)(3) is submitted herewith. It is requested that this information disclosure statement be entered into the record of the above-referenced matter.

The drawings are objected to under 37 C.F.R. 1.84(p)(5) because they do not include reference signs mentioned in the description. Specifically, element 1, representing a cardiac vessel and element R2, representing the second respiratory phase are not enumerated in drawings.

Fig. 1 shows, in the left-hand portion, a database 2 schematically with angiograms 3, 3a,.... The angiograms 3, 3a show the cardiac vessels 1. Fig. 1 has been amended to clearly enumerate the cardiac vessels 1. A corrected drawing sheet, which shows amended Fig. 1 and which complies with 37 C.F.R. 1.121(d) is submitted herewith. The corrected drawing sheet is labeled "Replacement Sheet" pursuant to 37 C.F.R. 1.121(d).

The drawings were further objected to as failing to include reference signs for element R2. Applicants respectfully submit that Figs. 3 and 4 clearly indicate a schematic representation of the heart position, the schematic having an X axis labeled R. The X axis further indicates reference points R0, R1, R2, R3, R4 and R5. As discussed in the subject specification on page 6, lines 23 to 32, from the data in Fig. 3, the function $f(R)$ represented in Fig. 4, which describes the heart position x dependent upon the respiratory phase may be calculated iteratively. During the iteration, the assumption is made at first that the function f is a constant that is independent of the respiratory phase R . From this starting point, one data pair of Fig. 3 linked by a line after the other is integrated into the curve. The curve shape is amended for each data pair such that the differences Δx_f calculated from the curve f always agree better with the measured differences Δx from Fig. 2. For instance, in the first iteration step, with the integration of a data pair $(R1, 0)$, $(R2, \Delta x)$ from Fig. 3, the constant function f is amended piece by piece into a new linear function f^* such that it gains an increasing linear course between $R1$ and $R2$, whereby $f^*(R2) - f^*(R1) = \Delta x$.

It is submitted that the drawings are now in compliance with 37 C.F.R. 1.84(p)(5). Withdrawal of the rejection of the drawings under 37 C.F.R. 1.84(p)(5) is respectfully requested.

Claim 2 stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention. Specifically, claim 2 recites the broad recitation approximately between 10 and 100. The claim also recites preferably between 30 and 50, which is the narrower statement of the range. Claim 2 has been amended to claim a device as claimed in claim 1, characterized in that the database (2) contains approximately between 10 and 100 angiograms (3). It is submitted that claim 2 now properly complies with 35 U.S.C. 112, second paragraph. Withdrawal of the rejection of claim 2 is respectfully requested.

Claims 1 and 3 to 10 stand rejected by the Action under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Application No.2003/0123606 to Mollus (hereinafter "Mollus"). Applicants respectfully submit that Mollus does not expressly or inherently disclose all of the elements set forth in independent claims 1 and 10. Thus, Mollus does not anticipate claims 1 and 10 or the claims which depend therefrom.

It is an object of the invention of claim 1 to provide a device and a method for providing an angiographic image of a body structure matching a given heartbeat phase and respiratory phase, wherein a representation of a current image of the body structure is superimposed on the provided angiographic image. Accordingly, claim 1 now claims a device for providing an angiographic image (A) of a body structure (1) matching a given heartbeat phase (H_d) and a respiratory phase (R_d), comprising a database (2) with

angiograms (3, 3a) of the body structure (1) from different heartbeat phases (H) and respiratory phases (R), and a data processing apparatus linked thereto, which is arranged to carry out the following steps: a) Calculation of a function (f), which describes a change (x) in the body structure (1) dependent upon the respiratory phase (R), which calculation takes place based on from the angiograms (3, 3a) in the database (2); b) Generation of the angiographic image (A) to be produced from at least one angiogram (3a) of the database (2), whose heartbeat phase (H_1) matches the given heartbeat phase (H_d) with the aid of the calculated function (f), wherein a representation of a current image of the body structure (1) is superimposed on the provided angiographic image (A).

In medical interventions of this type, the aim is to navigate a guide wire, balloon or stent on the tip of a catheter as precisely as possible to a site to be treated, such as a stenosis in a coronary vessel. The catheter is moved under constant X-ray fluoroscopic observation. On the associated recordings, however, the vessel system is not visible, since the patient cannot be continuously subjected to contrast medium injections. For this reason, a set of angiograms recorded before or during the intervention are used, which were generated with contrast medium administration and therefore clearly depict the vessel system. In order to support the physician, it is desirable to represent the static angiogram and the current X-ray image superimposed. Since, however, the heart continuously changes its form and position due to the heartbeat and the respiration, superpositioning as described in claim 1, produces satisfactory results because an

angiogram which matches the current image in relation to the heartbeat phase and respiratory phase is used for superpositioning.

Mollus does not disclose a device for providing an angiographic image (A) of a body structure (1) matching a given heartbeat phase (H_d) and a respiratory phase (R_d), comprising a database (2) with angiograms (3, 3a) of the body structure (1) from different heartbeat phases (H) and respiratory phases (R), and a data processing apparatus linked thereto, which is arranged to carry out the following steps: a) Calculation of a function (f), which describes a change (x) in the body structure (1) dependent upon the respiratory phase (R), which calculation takes place based on from the angiograms (3, 3a) in the database (2); b) Generation of the angiographic image (A) to be produced from at least one angiogram (3a) of the database (2), whose heartbeat phase (H_1) matches the given heartbeat phase (H_d) with the aid of the calculated function (f), wherein a representation of a current image of the body structure (1) is superimposed on the provided angiographic image (A). Specifically, Mollus fails to disclose a representation of a current image of the body structure (1) is superimposed on the provided angiographic image.

Rather, Mollus is directed to a method currently used in catheter laboratories, wherein the current X-ray image is displayed adjacent to a static angiogram. Thus, a treating physician, employing the method of Mollus, has to mentally merge the information from the two images. In fact, Mollus specifically discloses that the model (two-dimensional or three-dimensional) which best fits the instantaneous phase of the natural motion of the body is displayed on a monitor in synchronized form while the

current image is preferably displayed in parallel on a second monitor (Paragraph 009). Mollus further discloses that a two-dimensional projection of a three-dimensional model of the vascular system is used in step b) and that in respect of the type of image, such a two-dimensional projection corresponds to a normal two-dimensional fluoroscopic image, so that the physician can suitably compare the two images (Paragraph 010). Accordingly, Mollus fails to disclose a means whereby representation of a current image of the body structure is superimposed on the provided angiographic image, as now clearly claimed in claim 1.

Dependent claims 3 to 9 and new claim 11 depend from claim 1 and provide further features, thus claims 3 to 9 and 11 are clearly distinguishable over Mollus for at least the reasons discussed.

Independent claim 10 claims a method for providing an angiographic image (A) of a body structure (1) matching a given heartbeat phase (H_d) and a respiratory phase (R_d), based on a database (2) with angiograms (3, 3a) of the body structure (1) from different heartbeat phases (H) and respiratory phases (R), including the following steps:

a) Calculation of a function (f) which describes a change in the body structure (1) dependent upon the respiratory phase (R), which calculation takes place based on the angiograms (3, 3a) in the database (2); b) Generation of the angiographic image (A) to be provided from at least one angiogram (3a) of the database (2), whose heartbeat phase (H_1) matches the given heartbeat phase (H_d), with the aid of the calculated function (f),

wherein a representation of a current image of the body structure (1) is superimposed on the provided angiographic image (A). Claim 10 is patentable over Mollus for at least the reasons discussed with respect to claim 1. Accordingly, the Applicants respectfully request that the rejections under 35 U.S.C. § 102(e) of claims 1 to 10 be withdrawn and that claims 1 to 10 be allowed.

Claim 2 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Mollus in view of U.S. Patent 6,496,716 to Langer et al. (hereinafter "Langer"). Applicants respectfully submit that claim 2, depending from claim 1 is patentable over Mollus because Mollus fails to teach or suggest all the claim limitations of claim 1, as discussed. Specifically, Mollus fails to disclose a representation of a current image of the body structure that is superimposed on the provided angiographic image. Claim 2 further claims that the database contains approximately between 10 and 100 angiograms. Langer, similar to Mollus, fails to disclose a representation of a current image of the body structure that is superimposed on the provided angiographic image. Thus, Mollus and Langer, even when combined as suggested by the Action, fails to disclose each feature of claim 1. Accordingly, withdrawal of the rejection of claim 2 under 35 U.S.C. 103(a) is respectfully requested.

Allowance of claims 1 to 11 is earnestly solicited.

Conclusion

In view of the foregoing, Applicants respectfully submit that the specification, the drawings and all claims presented in this application are currently in condition for allowance. Accordingly, Applicants respectfully request favorable consideration and that this application be passed to allowance.

Should any changes to the claims and/or specification be deemed necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned to discuss the same.

Applicants' representative believes that this response is being filed in a timely manner. In the event that any extension and/or fee is required for the entry of this amendment the Commissioner is hereby authorized to charge said fee to Deposit Account No. 14-1270. An early and favorable action on the merits is earnestly solicited.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call David Barnes, Esq., Intellectual Property Counsel, Philips North America Corporation at the number below.

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Respectfully submitted,

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